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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :
SHINSUKE TOYOMASU, ET AL. : EXAMINER: PEZZUTO, H. L.
SERIAL NO: 10/663,667 :
FILED: SEPTEMBER 17, 2003 : GROUP ART UNIT: 1713
FOR: TRANSPARENT HEAT-RESISTANT :
RESIN OPTICAL MATERIAL AND FILM

DECLARATION UNDER 37 C.F.R. § 1.132

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

Now comes Shinsuke TOYOMASU who deposes and states:

1. That I am a graduate of Toyohashi University of Technology, Department of Engineering, School of Materials Science and received a bachelor's degree in the year 1987.
2. That I have been employed by Tosoh Corporation since April 1987 as a researcher in the field of polymer materials.
3. That I am an inventor of the present invention.
4. That the following experiments were carried out by me or under my direct supervision and control.

4.1 COMPARATIVE EXPERIMENTS

The following comparative experiments were conducted to clarify the difference in exhibition of optical compensating function between the cited references and the claimed invention.

EXPERIMENT 1

In a one-liter autoclave were charged 400 ml of toluene as a polymerization solvent, 0.001 moles of perbutyl neodecanoate as a polymerization initiator, 0.42 moles of N-(2-methylphenyl)maleimide, and 4.05 moles of isobutene, and the mixture was subjected to polymerization reaction under a polymerization condition at a polymerization temperature of 60°C for a polymerization time of 5 hours, to obtain N-(2-methylphenyl)maleimide-isobutene alternating copolymer. The thus obtained N-(2-methylphenyl)maleimide-isobutene alternating copolymer had a weight average molecular weight (M_w) (as reduced into standard polystyrene) of 160,000 and a molecular weight distribution (M_w/M_n), which is expressed by $[(\text{weight average molecular weight } (M_w))/(\text{number average molecular weight } (M_n))]$, of 2.7.

The N-(2-methylphenyl)maleimide-isobutene alternating copolymer obtained was molded using 50 tons compression molding machine (manufactured by Shinto Co.) at 270°C to obtain a sheet of 50 mm x 50 mm x 1 mm.

The sheet obtained had a light transmittance of 89%, a haze of 0.6%, a refractive index of 1.57, an Abbe number of 37, and a glass transition temperature (T_g) of 206°C.

As a result of judgment of positive and negative birefringence of this sheet in the same manner as described in the specification of the present application, it was found that positive birefringence portions and negative birefringence portions were intermixed depending on the measured position on the sheet, and it was difficult to judge.

It was also difficult to measure the retardation amount, and the sheet could not be found to function as an optical compensating material.

EXPERIMENT 2

In a one-liter autoclave were charged 400 ml of toluene as a polymerization solvent, 0.001 moles of perbutyl neodecanoate as a polymerization initiator, 0.42 moles of N-phenylmaleimide, and 4.05 moles of isobutene, and the mixture was subjected to polymerization reaction under a polymerization condition at a polymerization temperature of 60°C for a polymerization time of 5 hours, to obtain N-phenylmaleimide-isobutene copolymer. The thus obtained copolymer had a weight average molecular weight (M_w) of 162,000 and a molecular weight distribution (M_w/M_n) of 2.6.

The N-phenylmaleimide-isobutene copolymer obtained was molded using 50 tons compression molding machine (manufactured by Shinto Co.) at 270°C to obtain a sheet of 50 mm x 50 mm x 1 mm.

The sheet obtained had a light transmittance of 89%, a haze of 0.6%, a refractive index of 1.55, an Abbe number of 42, and a glass transition temperature (T_g) of 192°C.

As a result of judgment of positive and negative birefringence of this sheet in the same manner as described in the specification of the present application, it was found that positive birefringence portions and negative birefringence portions were intermixed depending on the measured position on the sheet, and it was difficult to judge.

It was also difficult to measure the retardation amount, and the sheet could not be found to function as an optical compensating material.

EXPERIMENT 3

In a one-liter autoclave were charged 400 ml of toluene as a polymerization solvent, 0.001 moles of perbutyl neodecanoate as a polymerization initiator, 0.56 moles of N-(2-methylphenyl)maleimide, 0.14 moles of N-methylmaleimide, and 4.05 moles of isobutene, and the mixture was subjected to polymerization reaction under a polymerization condition at

a polymerization temperature of 60°C for a polymerization time of 5 hours, to obtain N-(2-methylphenyl)maleimide-isobutene copolymer. The thus obtained copolymer had a weight average molecular weight (Mw) of 20,000 and a molecular weight distribution (Mw/Mn) of 2.7.

A ratio of N-(2-methylphenyl)maleimide unit to N-methylphenylmaleimide in the copolymer was 4/1 as a result of H-NMR measurement and elemental analysis, and the amount of the total maleimide units was 50 mol%.

The N-(2-methylphenyl)maleimide-N-methylmaleimide-isobutene copolymer obtained was molded using 50 tons compression molding machine (manufactured by Shinto Co.) at 270°C to obtain a sheet of 50 mm x 50 mm x 1 mm.

The sheet obtained had a light transmittance of 90%, a haze of 0.5%, a refractive index of 1.55, an Abbe number of 37, and a glass transition temperature (T_g) of 170°C.

As a result of judgment of positive and negative birefringence of this sheet in the same manner as described in the specification of the present application, positive birefringence was not confirmed in the sheet, and it was difficult to judge.

It was also difficult to measure the retardation amount, and the sheet did not have the optical properties to function as an optical compensating material.

EXPERIMENT 4

A solution of 25% by weight of the N-(2-methylphenyl)maleimide-N-methylmaleimide-isobutene copolymer obtained in Experiment 3 above and 75% by weight of methylene chloride was prepared and cast on a polyethylene terephthalate film. An N-(2-methylphenyl)maleimide-N-methylmaleimide-isobutene copolymer film formed after the methylene chloride had been volatilized and solidified from the solution was peeled. The film after peeling was dried at 100°C for 4 hours and further dried while raising the temperature

from 120°C to 160°C with an interval of 10°C for one hour at the respective temperature.

Thereafter, the resulting film was dried in vacuo at 180°C for 4 hours using a vacuum dryer, to obtain a film having a thickness of about 100 μm . The film was cut into a piece having a size of 5 cm x 5 cm, which was then stretched by +50% upon free-width uniaxial stretching under a condition at a temperature of 180°C and at a rate of stretching of 15 mm/min using a biaxial stretching machine (manufactured by Imoto Machinery Co., Ltd.), to obtain a stretched film.

The obtained stretched film showed positive birefringence, and had a retardation amount, $R_e = (n_x - n_y)d$, of +15 nm per 100 μm of the stretched film thickness. Here, d stands for a film thickness. The three-dimensional refractive indexes were $n_x=1.55385$, $n_y=1.55370$, and $n_z=1.55370$, thus $n_x > n_y = n_z$.

5. DISCUSSION OF THE RESULTS

The result of Experiment 1 was as follows. A sheet obtained by compression molding N-(2-methylphenyl)maleimide-isobutene copolymer used in Example 1 of the present application does not exhibit a negative birefringence, and it is difficult to measure a retardation amount. It is therefore apparent that an optical compensating function is not exhibited only due to a material (molecular structure).

The result of Experiment 2 was as follows. A sheet obtained by compression molding N-phenylmaleimide-isobutene copolymer used in Comparative Example 1 of the present application does not exhibit a positive birefringence, and it is difficult to measure a retardation amount. Similar to Experiment 1, it is apparent that an optical compensating function is not exhibited to only due a material (molecular structure).

The result of Experiment 3 was as follows. A sheet obtained by compression molding a terpolymer containing N-aryl substituted maleimide, N-alkyl substituted maleimide and

olefin, as described in JP 05-117334 cannot be judged in terms of positive and negative birefringence, and it is difficult to measure a retardation amount. Similar to Experiments 1 and 2, it is apparent that an optical compensating function is not exhibited to only due a material (molecular structure).

The result of Experiment 4 was as follows. The stretched film obtained showed a positive birefringence. Further, the retardation amount was very small, which was very small as an optical compensating function. Therefore, such a film cannot be expected to have an optical compensating function.

The results of the above Experiments clearly show that the optical compensating function (birefringence property) function is not exhibited to only due a molecular structure of a material used.

6. The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing therefrom.

7. Further deponent saith not.

Shinsuke Toyomasu
Signature

August 11, 2005
Date